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The contribution of work and non-work stressors to common mental disorders in the 2007 Adult Psychiatric Morbidity Survey

C. Clark^{1*}, C. Pike¹, S. McManus², J. Harris², P. Bebbington³, T. Brugha⁴, R. Jenkins⁵, H. Meltzer⁴, S. Weich⁶ and S. Stansfeld¹

¹ Barts & the London School of Medicine, Queen Mary University of London, London, UK

² National Centre for Social Research, London, UK

³ University College London, London, UK

⁴ University of Leicester, Leicester, UK

⁵ Institute of Psychiatry, London, London, UK

⁶ University of Warwick, Warwick, UK

Background. Evidence for an effect of work stressors on common mental disorders (CMD) has increased over the past decade. However, studies have not considered whether the effects of work stressors on CMD remain after taking co-occurring non-work stressors into account.

Method. Data were from the 2007 Adult Psychiatric Morbidity Survey, a national population survey of participants ≥ 16 years living in private households in England. This paper analyses data from employed working age participants ($N=3383$: 1804 males; 1579 females). ICD-10 diagnoses for depressive episode, generalized anxiety disorder, obsessive compulsive disorder, agoraphobia, social phobia, panic or mixed anxiety and depression in the past week were derived using a structured diagnostic interview. Questionnaires assessed self-reported work stressors and non-work stressors.

Results. The effects of work stressors on CMD were not explained by co-existing non-work stressors. We found independent effects of work and non-work stressors on CMD. Job stress, whether conceptualized as job strain or effort–reward imbalance, together with lower levels of social support at work, recent stressful life events, domestic violence, caring responsibilities, lower levels of non-work social support, debt and poor housing quality were all independently associated with CMD. Social support at home and debt did not influence the effect of work stressors on CMD.

Conclusions. Non-work stressors do not appear to make people more susceptible to work stressors; both contribute to CMD. Tackling workplace stress is likely to benefit employee psychological health even if the employee's home life is stressful but interventions incorporating non-work stressors may also be effective.

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Key words: Common mental disorders, life events, non-work stressors, social support, work stressors.

Introduction

In the UK, the recent Black report put the prevention of illness and the promotion of well-being and health at the heart of its vision for the working population (Black, 2008). Prospective evidence for an effect of psychosocial work stress on common mental disorders (CMDs) has increased over the past decade (Stansfeld & Candy, 2006; Siegrist, 2008), with studies assessing psychosocial work stress, characterized by job strain

(Karasek, 1979; Johnson & Hall, 1988) and effort–reward imbalance (ERI) (Siegrist, 1996) showing effects on anxiety and mood disorders (de Lange *et al.* 2003; Stansfeld & Candy, 2006; Netterstrom *et al.* 2008; Siegrist, 2008). Job strain and ERI are postulated to influence CMD via an imbalance between job demands and control (Karasek, 1979; Johnson & Hall, 1988) and job efforts and rewards (Siegrist, 1996), respectively. However, while associations have been established between psychosocial work stressors and CMD, other factors such as recent life events (Melchior *et al.* 2007), prior psychological ill health (Hammen, 2005; Clark *et al.* 2007a), childhood adversity (Rodgers, 1990; Clark *et al.* 2010), caring responsibilities (Weich *et al.* 2001; Pinquart & Sorensen,

* Address for correspondence: Dr C. Clark, Barts & the London School of Medicine & Dentistry, Queen Mary University of London, Old Anatomy Building, Charterhouse Square, London EC1M 6BQ, UK.

(Email: c.clark@qmul.ac.uk)

2003), socioeconomic status (Lorant *et al.* 2003), domestic abuse (Al-Modallal *et al.* 2008), housing quality (Weich *et al.* 2002; Clark *et al.* 2007b), work-to-family conflict (Lennon & Rosenfield, 1992; Allen *et al.* 2000) and social support (Stansfeld *et al.* 1997b; Fuhrer *et al.* 1999) also show robust associations with CMD, indicating that psychological disorders have a multifactorial causation (Hammen, 2005).

To date, only a few studies of psychosocial work stress and CMD have included non-work stressors. These studies suggest an independent effect of both work stressors and non-work stressors on depression and psychiatric sickness absence (Phelan *et al.* 1991; Stansfeld *et al.* 1997a, 1998; Weinberg & Creed, 2000; Cole *et al.* 2002; Griffin *et al.* 2002; Artazcoz *et al.* 2004; Wang, 2006; Melchior *et al.* 2007) but have poorly conceptualized and weakly measured non-work stressors, with studies tending to focus on only one type of non-work stressor. To better inform interventions for managing stress in the workplace, associations between work stressors and a range of different types of non-work stressors need exploring in general population samples. It is not known if interventions that focus solely on work stressors will be as effective in tackling CMD as interventions addressing both types of stressors.

We conducted analyses of the 2007 Adult Psychiatric Morbidity Survey (APMS) to determine the contribution of stressors in the workplace to psychological ill health compared with stressors from non-work domains in a general population sample. First, we examined the individual associations of CMD with a range of work stressors and non-work stressors (recent life events, caring responsibilities, domestic abuse, financial difficulties, poor housing quality and non-work social support). Interactions with gender were examined as the impact of stressors on CMDs differs for women and men, as do effects for non-work stressors (Kendler *et al.* 2001; Stansfeld & Candy, 2006; Oldehinkel & Bouma, 2010). Second, we determined the relative contribution of work stressors and non-work stressors to CMD by assessing whether any significant associations between work stressors and CMD were explained by adjustment for the non-work stressors. Finally, we examined whether non-work stressors such as social support (Phelan *et al.* 1991; Stansfeld *et al.* 1997b) and life events (Melchior *et al.* 2007) could also moderate effects of work stressors on CMD.

Method

Setting and participants

The 2007 APMS is a stratified probability sample survey conducted between October 2006 and December

2007 among adults aged ≥ 16 years living in private households in England (McManus *et al.* 2009). The response rate was 57% ($n=7461$); 30% refused and 13% were uncontactable (McManus *et al.* 2009). These analyses selected working age participants (males 16–65 years, females 16–60 years, based on retirement age for each gender) who were employees and had provided complete data on all of the work and non-work stressors ($N=3383$: 1804 males; 1579 females). The sample included those on short-term sickness absence but excluded those on longer-term sickness absence. Employment status was self-reported.

The survey had a multi-stage, stratified random probability sampling design, using the small users Postcode Address File as a sampling frame. Approximately 14 500 addresses were selected. Interviewers visited the addresses and one eligible occupant aged ≥ 16 years was randomly selected. Ethical approval for the APMS was awarded by the Royal Free Multi Regional Ethical Committee (Ref: 06/Q0501/71) (McManus *et al.* 2009). The survey involved a 90-min computer-assisted personal interview (CAPI), which assessed CMD, current work and non-work stressors and sociodemographic factors using standardized, validated self-report measures.

Measures

Common mental disorder

CMD was measured in the survey using a structured diagnostic interview – the Revised Clinical Interview Schedule, which assesses the prevalence of ICD-10 diagnoses of common depressive and anxiety disorders in the past 7 days (Lewis *et al.* 1992). CMD was defined as any diagnosis of depressive episode, generalized anxiety disorder, obsessive compulsive disorder, agoraphobia, social phobia, panic or mixed anxiety and depression.

Work stressors

ERI occurs when job efforts are high and rewards are low (Siegrist, 1996). Over-commitment, an individual's need for approval and esteem at work, can also exacerbate the effects of ERI on psychological health (Siegrist, 1996). ERI was measured using items from the ERI questionnaire (Siegrist *et al.* 2009) assessing the work environment in the past year. Effort was measured by three items assessing the demands of the work environment, e.g. having many interruptions and disturbances. Rewards were assessed using eight items covering job security, promotion prospects, respect and esteem. Over-commitment was assessed using six items assessing attitude to work. Reliability

for these scales was good; Cronbach's $\alpha=0.79$ for effort, 0.72 for reward and 0.80 for over-commitment.

The job demand-control model (JDC) (Karasek, 1979) proposes that job strain arises when high job demands are combined with low job control. The job demand-control-support model (JDCS) (Johnson & Hall, 1988) further accounts for the potential for social support at work to moderate the effect of high job demands on psychological health. JDC and JDCS were measured using questions adapted from the Whitehall II study (Karasek, 1979; North *et al.* 1996), assessing the work environment in the past year. Due to time constraints, demands were assessed using the questions measuring effort from the ERI model. Job control was measured using two items assessing the extent to which employees have control over their work. Social support in the workplace was assessed using four items, e.g. were colleagues willing to listen to their work-related problems? Reliability for these scales was good; Cronbach's $\alpha=0.73$ for control and 0.79 for social support at work. The ERI+over-commitment model and the JDCS questions are listed in full in the Appendix.

For both the ERI and the JDC/JDCS measures scores for each individual measure (effort/demands, rewards, over-commitment, control, workplace social support) were summed and divided into tertiles – high, mid, low. As in previous papers, analyses compare the high tertile for effort/demands and over-commitment with the mid- and low tertiles and the low tertile for rewards, control and social support with the mid- and high tertiles (Stansfeld *et al.* 1998; de Jonge *et al.* 2000). The high and low tertiles for the effort and reward measures were then used to allocate respondents into four categories assessing ERI: high effort/low reward (ERI); high effort/high reward; low effort/low reward; low effort/high reward. The tertiles for demands and control were used to allocate respondents into four categories assessing job strain: high demands/low control (job strain); high demands/high control; low demands/low control; low demands/high control.

Three further work-related stressors were assessed using the list of threatening experiences (LTE) (Brugha *et al.* 1985) measure of life events in the past 6 months. These were being made redundant, looking for work for >1 month and experiencing violence at work.

Non-work stressors

Recent life events, caring responsibilities, non-work social support, financial strain and housing quality were assessed using CAPI. Non-work life events in the past 6 months were assessed using the LTE (Brugha

et al. 1985), e.g. separation/divorce and financial difficulties.

Caring responsibilities were assessed using a dichotomous measure (no/yes) of whether the participant undertook caring responsibilities: $n=584$ reported caring for 0–10 h per week; $n=212$ reported >10 h per week. Debt was indicated by whether the household had become behind with payments for any of a range of bills and loans in the past year (Jenkins *et al.* 2008).

Non-work social support was assessed using the Interview Measure of Social Relationships (Brugha *et al.* 1987, 2003), a standardized validated measure. Scores on the items are summed and categorized as good support (score=21), mid-support (score 18–20) and low support (score <18).

Housing quality was assessed by a dichotomous measure based on whether there was mould in the respondent's home over the past year. This variable indicates poor housing quality in the UK as it is a marker of an energy-inefficient home and also indicates fuel-related poverty (Harris *et al.* 2010).

Domestic violence and abuse was assessed using computer-assisted self-interview to encourage full disclosure. A dichotomous variable contrasting the absence of domestic abuse with any report of domestic abuse was created from reports of whether in the past year a previous or current partner had hit them, slapped/pinned them down, threatened them with a weapon, threatened to kill them or used a weapon on them.

Sociodemographic factors

The analyses use measures of age, gender, tenure (home owned/mortgaged *versus* rented/other) and marital status (married; single; separated/divorced/widowed/other) (McManus *et al.* 2009).

Analysis

The prevalence of each work and non-work stressor for the sample and for those reporting CMD was established. Preliminary logistic regression analyses assessed associations between the individual work and non-work stressor measures and CMD, adjusted for gender, marital status, age and tenure. For job strain and ERI, subsequent adjustments were made for social support at work and over-commitment, respectively, to assess the full work stress models.

A multivariate regression model assessing the adjusted odds for CMD was then run, combining the JDCS work stressors and the non-work stressors. This model was adjusted for all the JDCS work and non-work stressors, which had been significantly

associated with CMD in the preliminary regression analyses, as well as age, gender, tenure and marital status. The potential moderators of gender, non-work social support and financial difficulties were examined using multiplicative interaction terms (Zammit *et al.* 2010*a,b*). This process was repeated for a multi-variable regression model combining the ERI+over-commitment work stressors and the non-work stressors.

Analyses were conducted in SPSS Version 16.0 (SPSS Inc., USA) using the complex samples analysis function taking weighting and survey design into account.

Results

Descriptives for the sample

The mean age was 38 years; 53% were male; 52% were married, 13% cohabiting, 27% single, 5% divorced and 3% widowed/separated; 16% owned their home, 57% were buying with a mortgage, 24% rented and 3% lived in the house for free.

Of the sample, 14.4% had a CMD defined as one or more of the following diagnoses: depressive episode; generalized anxiety disorder; mixed anxiety disorder; social phobia; agoraphobia; panic or obsessive compulsive disorder.

Prevalence of work stressors and associations with CMD

Nearly 12% of the sample reported job strain. Table 1 shows the associations of the JDC and the JDCS models with CMD, adjusted for gender, age, marital status and tenure. After adjustment for social support at work, job strain (high demands/low control) was associated with a three-fold increase in odds for CMD and an active job (high demands/high control) was associated with nearly double the odds. Low and mid-levels of social support at work were also significantly associated with increased odds of CMD.

Nearly 13% of the sample reported ERI. Table 1 also shows the associations of the ERI and the ERI+over-commitment models with CMD adjusted for gender, age, marital status and tenure. After adjustment for over-commitment, ERI (low rewards/high effort) was associated with a three-fold increase in odds for CMD and low reward with low effort was associated with double the odds. High over-commitment was associated with a 3.5-fold increase in odds for CMD.

No significant associations were observed between the work-related life events in the past 6 months – being made redundant, looking for work without success or violence at work – and CMD. No gender interactions were observed between the work stressors and CMD, with the exception of being made

redundant in the past 6 months ($p=0.047$). After stratification there was a significant effect of being made redundant on CMD for females [odds ratio (OR) 4.32, 95% CI 1.39–13.46] but not for males (OR 0.60, 95% CI 0.14–2.65) but these analyses were under-powered, with only 23 males and 15 females reporting redundancy in the past 6 months.

Prevalence of non-work stressors and associations with CMD

Table 2 shows the associations between the individual non-work stressors and CMD. In total, 18% of the sample reported experiencing at least one of the non-work life events in the past 6 months, which was associated with a 1.5-fold increase in odds for CMD. The serious illness/injury/assault of a close relative was associated with a 2.2-fold increase in odds for CMD, separation and divorce with nearly a 2.4-fold increase in odds, a major financial crisis with a 3.9-fold increase in odds and problems with the police with a 6.8-fold increase in odds. Domestic violence, caring responsibilities, low non-work social support, mould in the home and being in debt were also associated with increased odds for CMD (odds range = 1.84–3.59).

No gender interactions were observed between the non-work stressors and CMD, with the exception of being in trouble with the police ($p=0.018$): due to low power, only 10 males and five females reported this life event, preventing stratification by gender to further explore this finding.

Multivariable models of work and non-work stressors

JDCS

Table 3 shows the multivariate regression model, giving the adjusted odds for CMD for the JDCS work stressor measures and the non-work stressors, adjusted for age, gender, marital status and tenure. In this fully adjusted model, both work and non-work stressors were significantly associated with CMD. Job strain remained associated with nearly a three-fold increase in odds for CMD and an active job (high demands/high control) with nearly double the odds for CMD. Low and mid-levels of social support at work also remained associated with CMD. A serious illness/injury/assault to a close relative in the past 6 months, domestic violence in the past year, caring responsibilities, low and mid-levels of non-work social support, mould in the home and debt were associated with increased odds for CMD, with odds ranging from 1.59 to 2.79.

Table 1. Odds ratios showing the associations of job strain, effort–reward imbalance and work-related recent life events on common mental disorder adjusted for age, gender, tenure and marital status

	Odds for CMD		
	Adjusted for age, gender, tenure, marital status		
	N (%) 3383	Odds ratio	95 % CI
<i>(a) Job strain</i>			
JDC model			
Low demands, high control (no strain)	1210 (35.8)	1.00	
High demands, high control (active job)	1118 (33.0)	1.99	1.48–2.67
Low demands, low control (passive job)	653 (19.3)	1.41	0.97–2.03
High demands, low control (job strain)	401 (11.9)	3.31	2.34–4.68
JDCS model			
Low demands, high control (no strain)	1210 (35.8)	1.00	
High demands, high control (active job)	1118 (33.0)	1.90	1.42–2.56
Low demands, low control (passive job)	653 (19.3)	1.31	0.90–1.90
High demands, low control (job strain)	401 (11.9)	2.99	2.12–4.24
High social support at work	1756 (51.9)	1.00	
Mid social support at work	737 (21.8)	1.38	1.03–1.85
Low social support at work	890 (26.3)	1.71	1.32–2.23
<i>(b) ERI</i>			
High rewards, low effort	1427 (42.2)	1.00	
Low rewards, high effort (ERI)	434 (12.8)	4.84	3.52–6.66
Low rewards, low effort	437 (12.9)	2.46	1.77–3.41
High rewards, high effort	1085 (32.1)	1.96	1.47–2.60
ERI + over-commitment			
High rewards, low effort	1427 (42.2)	1.00	
Low rewards, high effort (ERI)	434 (12.8)	3.03	2.17–4.24
Low rewards, low effort	437 (12.9)	2.06	1.48–2.86
High rewards, high effort	1085 (32.1)	1.30	0.95–1.78
Low over-commitment	975 (28.8)	1.00	
Mid over-commitment	1125 (33.3)	1.10	0.77–1.57
High over-commitment	1283 (37.9)	3.52	2.57–4.81
<i>(c) Work-related recent life events</i>			
Made redundant			
No	3344 (98.9)	1.00	
Yes	38 (1.1)	1.95	0.88–4.35
Looking for work without success for > 1 month			
No	3327 (98.4)	1.00	
Yes	55 (1.6)	1.20	0.50–2.86
Experienced violence at work			
No	3355 (99.2)	1.00	
Yes	27 (0.8)	1.37	0.38–5.02

CMD, Common mental disorder; JDC, job demand-control; JDCS, job demand-control-support; ERI, effort–reward imbalance.

ERI model

Table 4 shows the multivariate regression model, giving the adjusted odds for CMD for the ERI + over-commitment work stressor measures and the non-work stressors, adjusted for age, gender, marital status and tenure. In this fully adjusted model, both work

and non-work stressors were significantly associated with CMD. ERI (low rewards/high effort) remained associated with nearly a three-fold increase in odds for CMD and low rewards/low effort with a 1.6-fold increase in odds for CMD. High over-commitment was associated with a 3.4-fold increase in odds for CMD. A serious illness/injury/assault to a close

Table 2. Odds ratios showing the associations of non-work stressors (recent life events, caring responsibilities, domestic violence, non-work social support, housing quality and financial strain) on common mental disorder adjusted for age, gender, tenure and marital status

	Odds for CMD		
	Adjusted for age, gender, tenure, marital status		
	N (%) 3383	Odds ratio	95 % CI
<i>(a) Recent non-work non-work life events</i>			
Serious illness/injury/assault to self			
No	3350 (99.0)	1.00	
Yes	32 (1.0)	2.17	0.92–5.13
Serious illness/injury/assault to close relative			
No	3312 (97.9)	1.00	
Yes	70 (2.1)	2.21	1.25–3.92
Death of an immediate family member			
No	3288 (97.2)	1.00	
Yes	94 (2.8)	1.51	0.84–2.70
Death of a close friend or other relative			
No	3172 (93.8)	1.00	
Yes	211 (6.2)	1.10	0.69–1.74
Separation or divorce			
No	3330 (95.8)	1.00	
Yes	52 (1.5)	2.38	1.16–4.87
Serious problem with a friend or relative			
No	3305 (97.7)	1.00	
Yes	77 (2.3)	1.93	0.99–3.77
Major financial crisis			
No	3357 (99.2)	1.00	
Yes	26 (0.8)	3.90	1.33–11.41
Problem with the police			
No	3367 (99.5)	1.00	
Yes	15 (0.5)	6.78	1.93–23.79
Something valuable was lost or stolen			
No	3309 (97.8)	1.00	
Yes	73 (2.2)	1.29	0.57–2.92
<i>(b) Domestic violence in the past 12 months</i>			
No	3147 (93.0)	1.00	
Yes	236 (7.0)	3.59	2.49–5.18
<i>(c) Caring responsibilities</i>			
No	2586 (76.4)	1.00	
Yes	797 (23.6)	2.17	1.69–2.77
<i>(d) Non-work social support</i>			
High social support	2515 (74.4)	1.00	
Mid social support	620 (18.3)	2.05	1.56–2.70
Low social support	248 (7.3)	2.62	1.80–3.81
<i>(e) Mould in the home</i>			
No	2883 (85.2)	1.00	
Yes	500 (14.8)	1.84	1.39–2.45
<i>(f) In debt</i>			
No	3101 (91.7)	1.00	
Yes	282 (8.3)	2.81	2.00–3.96

CMD, Common mental disorder.

relative in the past 6 months, domestic violence, caring responsibilities, low and mid-levels of non-work social support, mould in the home and debt also remained associated with increased odds for CMD, with odds ranging from 1.59 to 2.50.

Moderators of the effect of work stress on CMD

There was no significant interaction between JDC or ERI and non-work social support ($p=0.435$ and $p=0.475$). There was also no significant interaction

Table 3. Adjusted odds ratios showing associations of job-demand-control-support and non-work stressors on common mental disorder

	Adjusted odds for CMD ^a		
	N (%) 3383	Odds ratio	95% CI
Job strain			
Low demands, High control (no strain)	1210 (35.8)	1.00	
High demands, High control (active job)	1117 (33.0)	1.83	1.35–2.50
Low demands, Low control (passive job)	653 (19.3)	1.15	0.78–1.69
High demands, Low control (job strain)	401 (11.9)	2.79	1.95–4.01
Social support at work			
High	1756 (51.9)	1.00	
Mid	737 (21.8)	1.37	1.00–1.87
Low	890 (26.3)	1.55	1.18–2.04
Serious illness/injury/assault			
No	3350 (99.0)	1.00	
Yes	32 (1.0)	1.30	0.59–2.88
Serious illness/injury/assault to close relative			
No	3312 (97.9)	1.00	
Yes	70 (2.1)	1.91	1.02–3.58
Separation or divorce			
No	3330 (98.5)	1.00	
Yes	52 (1.5)	1.93	0.95–3.93
Serious problem with friend or relative			
No	3305 (97.7)	1.00	
Yes	77 (2.3)	1.25	0.58–2.67
Major financial crisis			
No	3357 (99.2)	1.00	
Yes	26 (0.8)	1.76	0.51–6.07
Problem with the police			
No	3367 (99.5)	1.00	
Yes	15 (0.5)	4.13	0.98–17.40
Domestic violence			
No	3147 (93.0)	1.00	
Yes	236 (7.0)	2.79	1.88–4.15
Caring responsibilities			
No	2586 (76.4)	1.00	
Yes	797 (23.6)	1.87	1.44–2.41
Non-work social support			
High	2515 (74.4)	1.00	
Mid	619 (18.3)	1.72	1.29–2.30
Low	248 (7.3)	2.16	1.42–3.28
Mould in home			
No	2883 (85.2)	1.00	
Yes	500 (14.8)	1.59	1.17–2.16
In debt			
No	3101 (91.7)	1.00	
Yes	282 (8.3)	1.94	1.34–2.81

CMD, Common mental disorder.

^a Adjusted odds ratios are derived from a model adjusting for age, gender, tenure, marital status, job strain, social support at work, serious illness/injury/assault to self, serious illness/injury/assault to close relative, separation or divorce, serious problem with a friend or relative, major financial crisis, problem with the police, domestic violence, caring responsibilities, non-work social support, mould in the home and being in debt.

Table 4. Adjusted odds ratios showing associations of effort–reward imbalance + over-commitment and non-work stressors on common mental disorder

	Odds for CMD ^a		
	N (%) 3383	Odds ratio	95 % CI
ERI + over-commitment model			
High rewards, low effort	1427 (42.2)	1.00	
Low rewards, high effort (ERI)	434 (12.8)	2.79	1.95–3.99
Low rewards, low effort	437 (12.9)	1.60	1.12–2.29
High rewards, high effort	1085 (32.1)	1.22	0.88–1.70
Over-commitment			
Low	975 (28.8)	1.00	
Mid	1125 (33.3)	1.11	0.78–1.58
High	1283 (37.9)	3.41	2.46–4.71
Serious illness/injury/assault			
No	3350 (99.0)	1.00	
Yes	32 (1.0)	1.16	0.47–2.84
Serious illness/injury/assault to close relative			
No	3312 (97.9)	1.00	
Yes	70 (2.1)	1.91	1.01–3.62
Separation or divorce			
No	3330 (98.5)	1.00	
Yes	52 (1.5)	2.03	0.98–4.20
Serious problem with friend or relative			
No	3305 (97.7)	1.00	
Yes	77 (2.3)	1.20	0.54–2.67
Major financial crisis			
No	3357 (99.2)	1.00	
Yes	26 (0.8)	1.47	0.39–5.58
Problem with the police			
No	3367 (99.5)	1.00	
Yes	15 (0.5)	3.91	0.92–16.58
Domestic violence			
No	3147 (93.0)	1.00	
Yes	236 (7.0)	2.50	1.66–3.75
Caring responsibilities			
No	2586 (76.4)	1.00	
Yes	797 (23.6)	1.89	1.45–2.48
Non-work social support			
High	2515 (74.4)	1.00	
Mid	619 (18.3)	1.65	1.23–2.21
Low	248 (7.3)	2.29	1.50–3.51
Mould in home			
No	2883 (85.2)	1.00	
Yes	500 (14.8)	1.59	1.16–2.18
In debt			
No	3100 (91.7)	1.00	
Yes	282 (8.3)	1.98	1.32–2.98

CMD, Common mental disorder; ERI, effort–reward imbalance.

^a Adjusted odds ratios are derived from a model adjusting for age, gender, tenure, marital status, job strain, over-commitment, serious illness/injury/assault to self, serious illness/injury/assault to close relative, separation or divorce, serious problem with a friend or relative, major financial crisis, problem with the police, domestic violence, caring responsibilities, non-work social support, mould in the home and being in debt.

between ERI and over-commitment ($p=0.887$) or between JDC or ERI and being in debt ($p=0.318$ and $p=0.427$).

Discussion

Main findings

In a representative general population sample, we found independent effects of work and non-work stressors on CMD. Job stress, whether conceptualized as job strain or ERI, together with lower levels of social support at work, recent stressful life events, domestic violence, caring responsibilities, lower levels of non-work social support, debt and poor housing quality were all independently associated with CMD. Effects of work stressors on CMD were not explained by co-existing non-work stressors. There were no gender differences in the associations observed between the stressors and CMD. Non-work social support and debt did not moderate the effect of work stressors on CMD.

Strengths and limitations

Due to the cross-sectional nature of this study, we are unable to assess causality between the work and non-work stressors and CMD. The analyses may overestimate the associations and need replicating with prospective data. Further limitations include: the reliance on self-reports of stressors and CMD; lack of examination of differential diagnoses of depression and anxiety because of the high prevalence of anxiety and/or co-morbid anxiety disorders; the possibility that poor psychological health may result in negative ratings of job characteristics (de Lange *et al.* 2003); a lack of assessment of personal vulnerability for psychological disorders (Weinberg & Creed, 2000); the use of the ERI model effort items to assess demands for the JDC model, which weakens the JDC model assessment; underpowered analyses for individual recent life events; the possibility that the non-work social support measure may reflect social support provided by work colleagues; lack of information about the number of roles within and outside the household; a lack of objective assessment of work characteristics and psychological health. Our sample excludes people with long-term sickness absence, which may influence the strength of associations observed. Our healthy worker sample may be more resilient than the general population.

This study is larger than the previous UK study, which sampled 64 healthcare workers (Weinberg & Creed, 2000). Other strengths include: the generalizability of the findings from this representative

sample, encompassing a broad range of occupations; the assessment of an extensive range of work and non-work stressors; and measures of non-work stressors, which are not limited to life events.

Work stressors

Job strain and ERI were strongly associated with CMD even after adjustment for non-work stressors, confirming previous prospective studies (Stansfeld & Candy, 2006; Siegrist, 2008). Given the cross-sectional data, our findings may overestimate the strength of the associations. However, high job demands coupled with high job control and high efforts coupled with high demands also significantly increased the odds for CMD. High control and high rewards were not protective for psychological health, as would be predicted (Karasek, 1979; Siegrist, 1996). Previous findings could be accounted for by sampling issues, as most studies use occupational samples. However, our findings may reflect that demands and efforts are more damaging for psychological health than for physical health, irrespective of levels of control and effort. In addition, jobs may have become more demanding in recent years, leading to less of a protective effect from control and rewards. Furthermore, the meaning of control may have changed in recent years as technological advances have eroded and altered the boundaries between work and home. Further research examining the moderating effect of control and rewards on the effect of high job demands/efforts on CMD in population samples is required before firmer conclusions can be drawn.

The effect sizes for the work stressors were little attenuated after adjustment for a wide range of non-work stressors, confirming their independent effect on CMD. One exception, where the attenuation was slightly larger, was for those with low reward/low effort jobs. Non-work stressors may play a slightly greater role in the aetiology of CMD for those with low reward/low effort jobs. This could reflect differences in resources or skills to cope with exposure to stressors and potential selection into low reward/low effort jobs for individuals with social disadvantage or previous CMD (Stansfeld *et al.* 2008).

Our study confirms previous findings that high levels of work social support are protective of psychological health (Stansfeld *et al.* 1997a; Stansfeld & Candy, 2006). The current study found no association between the work-related life events of being made redundant, looking for work or violence at work and CMD, which may reflect the lack of power for these analyses, as we would expect these events to be associated with CMD (Montgomery *et al.* 1999). Our analyses examined individuals who experienced

redundancy or unemployment but who found employment again quickly, which is likely to have had a counteracting positive effect on mental health. These associations are likely to differ in a sample including individuals who did not find employment again so quickly. Over-commitment, a measure of excessive striving, showed the strongest association with CMD in the current study and is associated with alterations in the hypothalamic-pituitary-adrenal axis system (Wirtz *et al.* 2010) and stress responses in the sympathetic nervous system (Wirtz *et al.* 2008). Over-commitment may capture elements of over-investment at work or work-life imbalance. However, over-commitment is also a measure of personality that may reflect low self-esteem; over-commitment could be influencing CMD independently of work characteristics. Over-commitment may prove to be an important aspect to be targeted in occupational interventions for psychological health and should be a focus of future research.

Non-work stressors

This study examines a broad array of non-work stressors, finding independent associations of domestic violence, caring responsibilities, mould in the home and being in debt with CMD, supporting previous findings (Weich *et al.* 2002; Lorant *et al.* 2003; Clark *et al.* 2007b; Al-Modallal *et al.* 2008). While the individual measures of recent life events were significantly associated with CMD, these associations were mediated by the other measures of work and non-work stressors. After adjustment, there remained only a significant association for serious illness/injury/assault of a close relative. In terms of implications for models of stress in the workplace, an employee with one or more of these stressors is at increased risk for poor psychological health, which could influence sickness absence.

Overall, the current survey found a lower prevalence and subsequently weaker associations between the life events and CMD than the previous APMS 2000 survey (Jordanova *et al.* 2007). While some of the associations between the life events with CMD were similar for the two surveys, e.g. relationship breakdown, associations for most life events were weaker and often non-significant in the APMS 2007 compared with the APMS 2000, e.g. death of a partner or close relative and problems with friends/relatives. The studies share a similar methodology and it is unclear why the findings differ over the 7-year period. The years preceding 2007 may have been beneficial for mental health in the UK but the difference could represent under-reporting of life events in the current survey. Whether similar differences in the prevalence

of life events are observed over this period in other panel studies should be examined. The low prevalence for events such as financial crisis, problems with the police and separation/divorce raise the possibility of type II errors. This seems likely given that the effect sizes for these life events in the multivariate models are similar to those for other life events that reach statistical significance.

Independent effects

Our study confirms previous findings of independent effects of work and non-work stressors on CMD (Phelan *et al.* 1991; Griffin *et al.* 2002), albeit using a broader range and multiple measures of work and non-work stressors. Non-work stressors do not appear to make a person more susceptible to work-related stressors. Weinberg & Creed (2000) found independent effects of work and non-work stressors on CMD in a small UK healthcare sample, which we replicate in a representative population sample. They found that lack of management support and conflict of work role were independently associated with CMD, while using theoretically based measures, we found effects for job strain and ERI. Taken together, the evidence supports the suggestion that models of stress in the workplace need to incorporate stress outside of the workplace, together with social support (Phelan *et al.* 1991). Moreover, the findings suggest that it is beneficial for employers to tackle workplace stress even if the employee's home life is stressful. The independent effects of work and non-work stressors imply that, potentially, gains can be made from improving the work environment alone.

Gender

Our study confirms those that find no gender differences in the effects of psychosocial work stress on psychological health (Netterstrom *et al.* 2008). The contrast with studies that suggest gender differences (Artazcoz *et al.* 2004; Chandola *et al.* 2004) may reflect the occupational homogeneity of those studies compared to the current study. The independent contribution of work and non-work stressors to CMD is compatible with other studies that have concluded that gender differences in rates of CMD are not explained by the number or type of social roles occupied by men and women (Weich *et al.* 1998, 2001). Our findings suggest that it may not be multiple roles that are important for CMD, but the strain experienced within each domain *per se*.

Moderators of work stress effects on psychological health

We found no support for hypothesized effects of non-work social support, debt and over-commitment as moderators of effects of work stressors on CMD. Other studies have also failed to demonstrate interactions between life events or family stressors or non-work social support and work stressors (Griffin *et al.* 2002; Wang, 2006; Melchior *et al.* 2007). Our findings, taken together with the independent effect of non-work and work stressors on CMD, are supportive of the additive burden model (Dohrenwend & Dohrenwend, 1981), which suggests that each stressor contributes uniquely and independently to CMD.

Conclusions

In terms of the prevention of illness, interventions for managing stress in the workplace have been focused on changing job conditions, teaching people skills to help them cope with job conditions and treating those experiencing high levels of distress (Briner, 1997). However, evidence for the effectiveness of interventions to improve workers' health and reduce sickness absence is limited (BOHRE, 2005; Nieuwenhuijsen *et al.* 2008). It has also been suggested that the early detection of psychological disorders is important (Weinberg & Creed, 2000) and we reiterate the suggestion that existing models of work stress be developed to incorporate non-work stressors. Interventions incorporating non-work stressors may be successful, as non-work stressors can trigger sickness absence. This is of vital importance given, in recent years, the increasing likelihood because of an

increase in dual-career couples and working mothers, that employees have substantial household responsibilities as well as work responsibilities (Allen *et al.* 2000). It would also be useful for future research to examine which factors predict sickness absence for those with CMD. The development of schemes that incorporate non-work stressors and an assessment of their effectiveness for the prevention of psychological ill health remains the next challenge. However, the findings of this study also suggest that schemes that tackle workplace stress alone may also be effective in improving employee psychological health.

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Declaration of Interest

S.M. and J.H. are employed by the National Centre for Social Research, the primary contractor for APMS 2007.

Appendix

ERI+over-commitment model

Job effort

I have constant time pressures due to heavy workload.
I have many interruptions and disturbances in my job.
Over the past few years, my job has become more and more demanding.

Job rewards

I receive the respect I deserve from my line manager.
Considering all my efforts and achievements, I receive the respect and prestige I deserve from my colleagues.
Considering all my efforts and achievements, I receive the respect and prestige I deserve from my clients.
Considering all my efforts and achievements, I receive the respect and prestige I deserve from my customers.
I have experienced or expect to experience an undesirable change in my work situation.
My job security is poor.
My job promotion prospects are poor.
Considering all my efforts and achievements, my work prospects are adequate.

Over-commitment

I get easily overwhelmed by time pressures at work.

As soon as I get up in the morning I start thinking about work problems.

When I get home I can easily relax and switch off work.

People too close to me say I sacrifice too much for my job.

Work rarely lets me go, it is still on my mind when I go to bed.

If I postpone something that I was supposed to do today I'll have trouble sleeping at night.

Job demand control social support model*Job control*

Do you have a choice in deciding how you go about your work?

Do you have a choice in deciding what you do at work?

Job demands

The same eight items listed under Job effort for the ERI+over-commitment model.

Social support in the workplace

Do you get help and support from your colleagues?

Are your colleagues willing to listen to your work-related problems?

Do you get help and support from your line manager?

Is your line manager willing to listen to your work-related problems?

Questions answered using a 4-point Likert scale (1=strongly agree; 2=agree; 3=disagree; 4=strongly disagree; or 1=often; 2=sometimes; 3=seldom; 4=never/almost never).

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